

REMARKS

In response to the final Office Action dated 28 March 2003, the applicant requests reconsideration of the above-identified application in view of the following remarks. Claims 36-39, 59-67, 71-85, and 98-99 are pending in the application, and are rejected. None of the claims have been amended.

Telephone interview

The applicant thanks Examiners Mondt and Flynn for the telephone interview granted on Friday, 21 March 2003, between themselves and the applicant's representative Mr. Mates (Reg. No. 35,271). The final Office Action dated 20 November 2002 and the applicant's response filed on 31 January 2003 were discussed. The Examiners agreed to provide the final Office Action dated 28 March 2003.

Rejections of Claims Under §103

All of the pending claims were rejected under under 35 USC § 103. The MPEP states the following with regard to rejections under 35 USC § 103:

“To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations.” MPEP 2143.

A Federal Circuit opinion states that the suggestion or motivation to combine references and the reasonable expectation of success must both be found in the prior art. MPEP 2143 citing *In re Vaeck*, 20 USPQ2d 1438, 1442 (Fed. Cir. 1991).

Multiple Federal Circuit decisions emphasize the need for the PTO to furnish evidence in support of claim rejections. For example, the Federal Circuit addressed citation of “basic knowledge and common sense” in rejections in *In re Zurko*, 59 USPQ2d 1693 (Fed. Cir. 2001):

“With respect to core factual findings in a determination of patentability, however, the Board [Board of Patent Appeals and Interferences] cannot simply reach conclusions based on its own understanding or experience – or on its assessment of what would be basic knowledge or common sense. Rather, the Board must point to some

concrete evidence in the record in support of these findings.” *In re Zurko*, 59 USPQ2d at 1697.

The Federal Circuit has particularly emphasized the need for the PTO to furnish evidence in support of claim rejections under 35 USC § 103 in *In re Lee*:

“When patentability turns on the question of obviousness, the search for and analysis of the prior art includes evidence relevant to the finding of whether there is a teaching, motivation, or suggestion to select and combine the references relied on as evidence of obviousness.The factual inquiry whether to combine references must be thorough and searching. ...It must be based on objective evidence of record.” *In re Lee*, 61 USPQ2d 1430, 1433 (Fed. Cir. 2002).

“the Board [Board of Patent Appeals and Interferences] must not only assure that the requisite findings are made, based on evidence of record, but must also explain the reasoning by which the findings are deemed to support the agency’s conclusion.Deferential judicial review under the Administrative Procedure Act does not relieve the agency of its obligation to develop an evidentiary basis for its findings.” *In re Lee*, 61 USPQ2d at 1434.

“when they [the Board] rely on what they assert to be general knowledge to negate patentability, that knowledge must be articulated and placed on the record.The board cannot rely on conclusory statements when dealing with particular combinations of prior art and specific claims, but must set forth the rationale on which it relies.” *In re Lee*, 61 USPQ2d at 1435.

The Office Action relies on scientific principles in several locations discussed below.

The MPEP addresses this type of rejection:

“The rationale to support a rejection under 35 U.S.C. 103 may rely on logic and sound scientific principle...However, when an examiner relies on a scientific theory, evidentiary support for the existence and meaning of that theory must be provided.” MPEP 2144.02, Page 2100-131.

The Office Action has not provided sufficient evidence to support the rejections of claims 36-39, 59-67, 71-85, and 98-99 under 35 USC § 103, and the applicant respectfully requests that evidence be provided or the rejections be withdrawn.

Claims 36 and 37 were rejected under 35 USC § 103(a) as being unpatentable over Fujiwara (U.S. Patent No. 5,798,548) in view of Weitzel et al. (U.S. Patent No. 5,661,312,

Weitzel) and Hamakawa et al. (JP 357126175A, Hamakawa). The applicant respectfully traverses.

The final Office Action referred to Fujiwara column 2, line 60 to column 3, line 6 as describing a thin insulator layer 116. This text of Fujiwara does not describe any of the elements cited in the rejection.

The final Office Action states that “as shown by Weitzel et al it has long been known silicon carbide can be used as gate material to achieve better breakdown performance.” Final Office Action, page 7. The abstract of Weitzel states that a “silicon carbide MOSFET (10) is formed to have a high breakdown voltage” and “[t]he increased depletion region width improves the breakdown voltage.” Weitzel, abstract. However, Weitzel does not show that the silicon carbide gate material is what improves breakdown voltage. The improved breakdown voltage is due to other factors according to Weitzel. Weitzel also says in the abstract that “[t]he breakdown enhancement layer (20) has a lower doping concentration that increases the width of a depletion region (24) near a gate insulator (17). The increased depletion region width improves the breakdown voltage.” Weitzel, abstract.

The final Office Action states that “[t]he selection of silicon carbide is based on its ability to deplete a wide region 24 on the basis of its high work function, while said depletion is clearly stated to be beneficial to breakdown problem improvement through the widening of region 24 (see column 1, lines 58-67).” Final Office Action, page 3. On the contrary, Weitzel does not state a relation between silicon carbide and breakdown voltage in the cited text. Weitzel says that the gate material is selected because it has “a work function that is sufficiently high to create a depletion region 24.” Weitzel, column 1, lines 58-60. Silicon carbide is mentioned as only one of four suitable gate materials, the others being diamond, aluminum nitride, and gallium nitride. Weitzel, column 1, lines 63-64. Weitzel also says that it is the heavy doping that increases the width of the depletion region 24, not silicon carbide. Weitzel, column 1, lines 64-67. Weitzel is not evidence for substituting a silicon carbide gate into the structure of Fujiwara. The final Office Action has not presented evidence of a connection between the silicon carbide of Weitzel and improved breakdown performance.

The final Office Action states that “Applicant is reminded of the proportionality between voltage and current...” and continues with technical argument. Final Office Action, page 3. If

the final Office Action is relying on a scientific theory here, the applicant respectfully requests that evidentiary support for the existence and meaning of this scientific theory be provided as is required by MPEP 2144.02. The rejection is not supported by concrete evidence in the record as is required by *In re Zurko*.

The final Office Action cited *In re Peterson*, 65 USPQ2d 1379 (Fed. Cir. 2003) which addressed overlapping ranges in a rejection under 35 USC §103. Final Office Action, page 3. The applicant respectfully submits that *In re Peterson* does not change the law requiring evidence showing a teaching, motivation, or suggestion to select and combine the references relied on as evidence of obviousness as is required by *In re Lee*. The final Office Action has not provided such evidence required to support a *prima facie* case of obviousness.

The final Office Action states that “Hamakawa et al teach that $\text{Si}_{1-x}\text{C}_x$ with $x>0.5$ can be selected as an excellent material for obtaining high electronic conversion efficiency” as the motivation for combining Hamakawa with Fujiwara and Weitzel. Final Office Action, pages 7-8. Hamakawa does state its purpose is to “obtain high optoelectric conversion efficiency when a heterojunction optoelectric element is to be formed.” Hamakawa, Abstract. However, this is not a suggestion to modify Fujiwara or Weitzel because neither Fujiwara nor Weitzel is described as an optoelectric element or a heterojunction. Heterojunctions are a special class of semiconductor devices. The final Office Action has not shown evidence why a high optoelectronic conversion efficiency is desirable for Fujiwara or Weitzel, neither of which describes an optoelectric element. The final Office Action has not identified a suggestion in the prior art for adding a part of the heterojunction optoelectric element of Hamakawa to the structures of either Fujiwara or Weitzel as is required by *In re Lee*.

The final Office Action states that “[a]lternatively, from the point of view of well-established physics data on $\text{Si}_{1-x}\text{C}_x$ it can be expected that $\text{Si}_{1-x}\text{C}_x$ within a neighborhood of $x=0.5$ can be used to achieve even better results as those obtained with SiC.” Final Office Action, page 8. Evidentiary support for the existence and meaning of this scientific theory has not been provided as is required by MPEP 2144.02. The rejection is not supported by concrete evidence in the record as is required by *In re Zurko*.

With regard to claim 37, the final Office Action states that “it is clear that ordinary skills can be applied to this art to determine x so as to optimize the desired value of the electron

affinity or barrier energy.” Final Office Action, page 8. The final Office Action has not provided evidence of how “ordinary skills can be applied to this art” in light of Hamakawa to arrive at the claimed invention. The rejection is not supported by concrete evidence in the record as is required by *In re Zurko*.

The final Office Action has not provided evidence showing a teaching, motivation, or suggestion to select and combine Hamakawa, Fujiwara, and Weitzel as is required by *In re Lee*.

The final Office Action has not presented prior art showing a reasonable expectation of success of this particular combination of Hamakawa, Fujiwara, and Weitzel as is required by *In re Vaeck*.

The applicant respectfully submits that a *prima facie* case of obviousness of claims 36 and 37 has **not** been established in the final Office Action, and that claims 36 and 37 are in condition for allowance.

Claims 41-44 were rejected under 35 USC § 103(a). Claims 41-44 have been cancelled without prejudice.

Claims 36-39 were rejected under 35 USC § 103(a) as being unpatentable over Weitzel in view of Hamakawa. The applicant respectfully traverses.

The final Office Action states that “[r]esistivity and reflectivity are related, as shown by the well-known Kramers-Kronig relations.” Final Office Action, page 10. Evidentiary support for the existence and meaning of this scientific theory has not been provided as is required by MPEP 2144.02. The rejection is not supported by concrete evidence in the record as is required by *In re Zurko*.

The final Office Action states that “[o]bviously, a lower electron affinity is the cause of the improvement of said photoelectric conversion efficiency” in referring to Hamakawa. Final Office Action, page 10. This statement is not supported by concrete evidence in the record as is required by *In re Zurko*.

The final Office Action states that “application of the MOSFET device taught by Weitzel et al to the field of memory and light detection devices would make incorporation of the teaching of Hamakawa et al through the use of a gate layer formed of $\text{Si}_{1-x}\text{C}_x$ obvious.” Final Office

Action, page 10. There is no evidence in the record that memory devices and light detection devices are related such that one skilled in the art would combine Weitzel and Hamakawa. The final Office Action has not identified a suggestion in the prior art for adding a part of a heterojunction optoelectric element to the structure of Weitzel which is not described as a heterojunction optoelectric element. There is no evidence cited to support this conclusion of obviousness as is required by *In re Lee* and *In re Zurko*.

The final Office Action states that “the examiner has given a physics argument for increasing the carbon content more than mere infinitesimally based on Hamakawa.” Final Office Action, page 10. Evidentiary support for the existence and meaning of this scientific theory has not been provided as is required by MPEP 2144.02. The rejection is not supported by concrete evidence in the record as is required by *In re Zurko*.

The final Office Action states that “[t]he art taught by Hamakawa et al has had plenty of time to mature, which justifies reasonable expectation of success.” Final Office Action, pages 10-11. The final Office Action has not presented prior art showing the reasonable expectation of success of this particular combination of Hamakawa and Weitzel as is required by *In re Vaeck*. The rejection is not supported by concrete evidence in the record as is required by *In re Zurko*.

With regard to claim 37, the final Office Action states that “that x is to be “selected at a predetermined value” is just common practice because it is understood that device parameters are arrived at after some optimization effort.” Final Office Action, page 11. The final Office Action has not provided evidence of how “some optimization effort” leads one skilled in the art to arrive at the claimed invention. The final Office Action has not provided evidence of what is “understood.” The rejection is not supported by concrete evidence in the record as is required by *In re Zurko*.

The final Office Action has not provided evidence showing a teaching, motivation, or suggestion to select and combine Hamakawa and Weitzel as is required by *In re Lee*.

The applicant respectfully submits that a *prima facie* case of obviousness of claims 36-39 has **not** been established in the final Office Action, and that claims 36-39 are in condition for allowance.

Claim 59 was rejected under 35 USC § 103(a) as being unpatentable over Fujiwara in view of Weitzel and Hamakawa. The applicant respectfully traverses.

The final Office Action states that “the use of silicon carbide gates in the art of field effect transistors to achieve better breakdown performance is evident from Weitzel et al (cf abstract and claim 10).” Final Office Action, page 11. Weitzel does not show this. The abstract of Weitzel states that a “silicon carbide MOSFET (10) is formed to have a high breakdown voltage” and “[t]he increased depletion region width improves the breakdown voltage.” Weitzel, abstract. However, Weitzel does not show that the silicon carbide gate material is what improves breakdown voltage. The improved breakdown voltage is due to other factors according to Weitzel. Weitzel also says in the abstract that “[t]he breakdown enhancement layer (20) has a lower doping concentration that increases the width of a depletion region (24) near a gate insulator (17). The increased depletion region width improves the breakdown voltage.” Weitzel, abstract. Claim 10 lists four different gate materials suitable for Weitzel’s MOSFET including silicon carbide, aluminum nitride, gallium nitride, and diamond. Silicon carbide is clearly not described as being the cause of the improved breakdown voltage because it could be replaced by aluminum nitride, gallium nitride, or diamond according to claim 10 of Weitzel. Weitzel is not evidence for substituting a silicon carbide gate into the structure of Fujiwara. The final Office Action has not presented evidence of a connection between the silicon carbide of Weitzel and improved breakdown performance. The final Office Action has not provided evidence showing a teaching, motivation, or suggestion to select and combine Fujiwara, Weitzel, and Hamakawa as is required by *In re Lee*.

The final Office Action states that “ $\text{Si}_{1-x}\text{C}_x$ with $x > 0.5$ as an electrode contact layer with predetermined stoichiometric composition to lower the electron affinity has long been known....as witnessed by...Hamakawa.” Final Office Action, page 12. Hamakawa does not mention a lower electron affinity. The rejection is not supported by concrete evidence in the record as is required by *In re Zurko*.

The final Office Action indicates that the art of MOSFET transistors is related to the art of photoelectric conversion. Final Office Action, page 12. The final Office Action has not provided evidence of this relation. The rejection is not supported by concrete evidence in the record as is required by *In re Zurko*.

The final Office Action states that “[o]bviously, the photoelectric conversion efficiency is favorably affected by the lowering of the electron affinity.” Final Office Action, page 12. Evidentiary support for the existence and meaning of this scientific theory has not been provided as is required by MPEP 2144.02. The rejection is not supported by concrete evidence in the record as is required by *In re Zurko*.

The final Office Action has not presented prior art showing a reasonable expectation of success of this particular combination of Fujiwara, Weitzel, and Hamakawa as is required by *In re Vaeck*.

The applicant respectfully submits that a *prima facie* case of obviousness of claim 59 has **not** been established in the final Office Action, and that claim 59 is in condition for allowance.

Claim 60 was rejected under 35 USC § 103(a) as being unpatentable over Fujiwara, Weitzel, Hamakawa, and Miyawaki (U.S. Patent No. 5,808,336). The applicant respectfully traverses.

The final Office Action has not provided evidence showing a teaching, motivation, or suggestion to select and combine Fujiwara, Weitzel, Hamakawa, and Miyawaki as is required by *In re Lee*. The final Office Action referred to Miyawaki column 9, lines 1-10 that describe a floating gate and an insulating layer, but has not identified prior art suggesting the combination of Fujiwara, Weitzel, Hamakawa, and Miyawaki.

The final Office Action has not presented prior art showing a reasonable expectation of success of this particular combination of Fujiwara, Weitzel, Hamakawa, and Miyawaki as is required by *In re Vaeck*. The rejection is not supported by concrete evidence in the record as is required by *In re Zurko*.

The applicant respectfully submits that a *prima facie* case of obviousness of claim 60 has **not** been established in the final Office Action, and that claim 60 is in condition for allowance.

Claim 61 was rejected under 35 USC § 103(a) as being unpatentable over Fujiwara, Weitzel, Hamakawa, and Shrivastava et al (U.S. Patent No. 5,557,122, Shrivastava). The applicant respectfully traverses.

Claim 61 recites the transistor of claim 59 wherein the gate comprises a material selected from the group consisting of a monocrystalline silicon carbide compound, a polycrystalline silicon carbide compound, a microcrystalline silicon carbide compound, and a nanocrystalline silicon carbide compound.

Shrivastava relates to a semiconductor electrode but does not show silicon carbide. The final Office Action has not provided evidence why Shrivastava is being applied if Shrivastava does not show an element recited in claim 61. The rejection is not supported by concrete evidence in the record as is required by *In re Zurko*.

The final Office Action states that Shrivastava shows “improved stress induced defect problems (cf. abstract).” Final Office Action, page 13. The abstract of Shrivastava states that “silicon oxide grown from the the floating gate (206) has fewer stress induced defects.” Shrivastava, abstract. The final Office Action has not provided evidence that the devices in Fujiwara, Weitzel, or Hamakawa as combined include silicon oxide grown from a floating gate that would benefit from this advantage. The final Office Action has not provided evidence showing a teaching, motivation, or suggestion to select and combine all of Fujiwara, Weitzel, Hamakawa, and Shrivastava as is required by *In re Lee*.

The final Office Action states that “[c]ombination does not offer problems of any device or method of making nature: the floating gate can be manufactured to be microcrystalline by straightforward application of P-doping (cf. abstract). Reasonable expectation of success is thus valid. Final Office Action, page 13. Shrivastava describes a floating gate of nitrogen doped amorphous silicon that results in the advantage of fewer stress induced defects. Shrivastava, abstract. The final Office Action has not indicated that the device resulting from the combination of Fujiwara, Weitzel, Hamakawa, and Shrivastava has a floating gate of amorphous silicon that could benefit from nitrogen doping. The final Office Action has not presented prior art showing a reasonable expectation of success of this particular combination of all of Fujiwara, Weitzel, Hamakawa, and Shrivastava as is required by *In re Vaeck*. The rejection is not supported by concrete evidence in the record as is required by *In re Zurko*.

The applicant respectfully submits that a *prima facie* case of obviousness of claim 61 has not been established in the final Office Action, and that claim 61 is in condition for allowance.

Claims 62 and 65 were rejected under 35 USC § 103(a) as being unpatentable over Fujiwara in view of Halvis et al. (U.S. Patent No 5,369,040, Halvis). The applicant respectfully traverses.

Fujiwara relates to a semiconductor device having multiple control gates, and its use in a memory device. Fujiwara, abstract and summary. Halvis relates to a MOS photodetector having an overlapping gate array. Halvis, abstract. Fujiwara is apparently not a photodetector. The addition of carbon in Halvis is described as improving transparency to visible light. Halvis, abstract. The final Office Action has not provided evidence showing why one skilled in the art would apply the teaching of Halvis to the device of Fujiwara which is not a photodetector. The final Office Action states that the motivation for the combination “stems from the cost of introducing the carbon.” Final Office Action, page 14. There is no cited evidence supporting this motivation. The final Office Action has not provided evidence showing a teaching, motivation, or suggestion to select and combine all of Fujiwara and Halvis as is required by *In re Lee*. The rejection is not supported by concrete evidence in the record as is required by *In re Zurko*.

The final Office Action states that “[t]he process of making the device is actually simplified and shortened so that reasonable expectation of success in the combination of the invention is assured.” Final Office Action, page 14. There is no cited evidence supporting this assertion. The final Office Action has not presented prior art showing a reasonable expectation of success of this particular combination of Fujiwara and Halvis as is required by *In re Vaeck*. The rejection is not supported by concrete evidence in the record as is required by *In re Zurko*.

The applicant respectfully submits that a *prima facie* case of obviousness of claims 62 and 65 has **not** been established in the final Office Action, and that claims 62 and 65 are in condition for allowance.

Claim 63 was rejected under 35 USC § 103(a) as being unpatentable over Fujiwara, Halvis, and Miyawaki. The applicant respectfully traverses.

This rejection is based on Fujiwara, Halvis, and Miyawaki, yet Forbes and Hamakawa are mentioned in the rejection.

The final Office Action has not provided evidence showing a teaching, motivation, or suggestion to select and combine all of Fujiwara, Halvis, Miyawaki, Forbes, and Hamakawa as is required by *In re Lee*.

The final Office Action has not presented prior art showing a reasonable expectation of success of this particular combination of Fujiwara, Halvis, Miyawaki, Forbes, and Hamakawa as is required by *In re Vaeck*.

The rejection is not supported by concrete evidence in the record as is required by *In re Zurko*.

The applicant respectfully submits that a *prima facie* case of obviousness of claim 63 has **not** been established in the final Office Action, and that claim 63 is in condition for allowance.

Claim 64 was rejected under 35 USC § 103(a) as being unpatentable over Fujiwara, Halvis, and Shrivastava. The applicant respectfully traverses.

The final Office Action states that “Shrivastava et al. teach a floating gate that retains its microcrystalline structure so as to have improved stress induced defect problems (cf. abstract).” Final Office Action, page 15. The abstract of Shrivastava states that “silicon oxide grown from the the floating gate (206) has fewer stress induced defects.” Shrivastava, abstract. The final Office Action has not provided evidence that the device from Fujiwara and Halvis as combined includes silicon oxide grown from a floating gate that would benefit from this advantage. The final Office Action has not provided evidence showing a teaching, motivation, or suggestion to select and combine all of Fujiwara, Halvis, and Shrivastava as is required by *In re Lee*.

The final Office Action has not presented prior art showing a reasonable expectation of success of this particular combination of Fujiwara, Halvis, and Shrivastava as is required by *In re Vaeck*.

The rejection is not supported by concrete evidence in the record as is required by *In re Zurko*.

The applicant respectfully submits that a *prima facie* case of obviousness of claim 64 has **not** been established in the final Office Action, and that claim 64 is in condition for allowance.

Claim 66 was rejected under 35 USC § 103(a) as being unpatentable over Fujiwara, Halvis, and Miyawaki. The applicant respectfully traverses.

This rejection is based on Fujiwara, Halvis, and Miyawaki, yet Forbes is also mentioned in the rejection.

The final Office Action states that “superior mobility of the charge carriers in the channel a P-type substrate is obviously preferable in the case of silicon, because the electron mobility exceeds the hole mobility.” Final Office Action, page 15. Evidentiary support for the existence and meaning of this scientific theory has not been provided as is required by MPEP 2144.02. The final Office Action has also not provided evidence showing a teaching, motivation, or suggestion to select and combine all of Fujiwara, Halvis, Forbes, and Miyawaki as is required by *In re Lee*.

The final Office Action states that “silicon dioxide is widely used as gate insulation layer for its excellent insulator properties, and hence combinability of the inventions is guaranteed with reasonable expectation of success.” Final Office Action, page 16. The final Office Action has not presented prior art showing this reasonable expectation of success of this particular combination of Fujiwara, Halvis, Forbes, and Miyawaki as is required by *In re Vaeck*.

The rejection is not supported by concrete evidence in the record as is required by *In re Zurko*.

The applicant respectfully submits that a *prima facie* case of obviousness of claim 66 has **not** been established in the final Office Action, and that claim 66 is in condition for allowance.

Claim 67 was rejected under 35 USC § 103(a) as being unpatentable over Fujiwara, Halvis, and Shrivastava. The applicant respectfully traverses.

The final Office Action states that “Shrivastava et al. teach a floating gate that retains its microcrystalline structure so as to have, inter alia, improved stress induced defect problems (cf. abstract).” Final Office Action, page 16. The abstract of Shrivastava states that “silicon oxide grown from the the floating gate (206) has fewer stress induced defects.” Shrivastava, abstract. The final Office Action has not provided evidence that the device from Fujiwara and Halvis as combined includes silicon oxide grown from a floating gate that would benefit from this advantage. The final Office Action has not provided evidence showing a teaching, motivation,

or suggestion to select and combine all of Fujiwara, Halvis, and Shrivastava as is required by *In re Lee*.

The final Office Action states that “[c]ombination does not offer problems of any device or method of making nature: the floating gate can be manufactured to be microcrystalline by straightforward application of P-doping (cf. abstract). Reasonable expectation of success is thus valid. Final Office Action, page 16. Shrivastava describes a floating gate of nitrogen doped amorphous silicon that results in the advantage of fewer stress induced defects. Shrivastava, abstract. The final Office Action has not indicated that the device resulting from the combination of Fujiwara, Halvis, and Shrivastava has a floating gate of amorphous silicon that could benefit from nitrogen doping. The final Office Action has not presented prior art showing a reasonable expectation of success of this particular combination of all of Fujiwara, Halvis, and Shrivastava as is required by *In re Vaack*.

The rejection is not supported by concrete evidence in the record as is required by *In re Zurko*.

The applicant respectfully submits that a *prima facie* case of obviousness of claim 67 has **not** been established in the final Office Action, and that claim 67 is in condition for allowance.

Claims 71, 80, and 83 were rejected under 35 USC § 103(a) as being unpatentable over Fujiwara, Weitzel, and Hamakawa. The applicant respectfully traverses.

The final Office Action states that “it has long been known silicon carbide gates improve breakdown performance of field effect transistors.” Final Office Action, page 17. The final Office Action has not provided evidence supporting this assertion. The rejection is not supported by concrete evidence in the record as is required by *In re Zurko*.

The final Office Action states that “in the related field of optoelectronic devices it has long been known that $\text{Si}_{1-x}\text{C}_x$ with $x > 0.5$ can be selected as an excellent material for obtaining high optoelectronic conversion, because of the low barrier properties of the gate-insulator system, as shown by...Hamakawa (cf. “Purpose” and “Constitution” in the English summary).” Final Office Action, page 17. Hamakawa does state its purpose is to “obtain high optoelectric conversion efficiency when a heterojunction optoelectric element is to be formed.” Hamakawa, Abstract. However, this is not a suggestion to modify Fujiwara or Weitzel because neither

Fujiwara nor Weitzel is described as an optoelectric element or a heterojunction.

Heterojunctions are a special class of semiconductor devices. The final Office Action has not shown evidence why a high optoelectronic conversion efficiency is desirable for Fujiwara or Weitzel, neither of which describes an optoelectric element. Hamakawa does not mention “low barrier properties of the gate-insulator system.” The final Office Action has not identified a suggestion in the prior art for adding a part of the heterojunction optoelectric element of Hamakawa to the structures of either Fujiwara or Weitzel as is required by *In re Lee*.

The final Office Action states that “[a]lternatively, from the point of view of well-established physics data on $\text{Si}_{1-x}\text{C}_x$ it can be expected that $\text{Si}_{1-x}\text{C}_x$ within a neighborhood of $x=0.5$ can be used to achieve even better results as those obtained with SiC.” Final Office Action, page 17. Evidentiary support for the existence and meaning of this scientific theory has not been provided as is required by MPEP 2144.02. The rejection is not supported by concrete evidence in the record as is required by *In re Zurko*.

The final Office Action states that the compound of SiC mentioned would be simpler to manufacture. Final Office Action, page 17. The final Office Action has not provided evidence supporting this assertion. The rejection is not supported by concrete evidence in the record as is required by *In re Zurko*.

The final Office Action has not presented prior art showing a reasonable expectation of success of this particular combination of all of Fujiwara, Weitzel, and Hamakawa as is required by *In re Vaeck*.

The applicant respectfully submits that a *prima facie* case of obviousness of claims 71, 80, and 83 has **not** been established in the final Office Action, and that claims 71, 80, and 83 are in condition for allowance.

Claims 72, 81, and 84 were rejected under 35 USC § 103(a) as being unpatentable over Fujiwara, Weitzel, Hamakawa, and Miyawaki. The applicant respectfully traverses.

The final Office Action states that “it is generally understood in the art that silicon dioxide is a very good and easy-to-make interlayer dielectric.” Final Office Action, page 17. The final Office Action has not provided evidence supporting this assertion. The rejection is not supported by concrete evidence in the record as is required by *In re Zurko*.

The final Office Action states that “[e]ase of making has already been referred to as well.” Final Office Action, page 17-18. The final Office Action has not provided evidence supporting this assertion. The final Office Action has not presented prior art showing a reasonable expectation of success of this particular combination of all of Fujiwara, Weitzel, Hamakawa, and Miyawaki as is required by *In re Vaeck*. The rejection is not supported by concrete evidence in the record as is required by *In re Zurko*.

The final Office Action has not provided evidence showing a teaching, motivation, or suggestion to select and combine Fujiwara, Weitzel, Hamakawa, and Miyawaki as is required by *In re Lee*.

The applicant respectfully submits that a *prima facie* case of obviousness of claims 72, 81, and 84 has **not** been established in the final Office Action, and that claims 72, 81, and 84 are in condition for allowance.

Claims 73, 82, and 85 were rejected under 35 USC § 103(a) as being unpatentable over Fujiwara, Weitzel, Hamakawa, and Shrivastava. The applicant respectfully traverses.

This rejection is based on Fujiwara, Weitzel, Hamakawa, and Shrivastava, yet Miyawaki, is also mentioned in the rejection.

The final Office Action states that “Shrivastava et al. teach a floating gate that retains its microcrystalline structure so as to have improved stress induced defect problems (cf. abstract).” Final Office Action, page 18. The abstract of Shrivastava states that “silicon oxide grown from the the floating gate (206) has fewer stress induced defects.” Shrivastava, abstract. The final Office Action has not provided evidence that the device from Fujiwara, Weitzel, Hamakawa, Miyawaki, and Shrivastava as combined includes silicon oxide grown from a floating gate that would benefit from this advantage. The final Office Action has not provided evidence showing a teaching, motivation, or suggestion to select and combine all of Fujiwara, Weitzel, Hamakawa, Miyawaki, and Shrivastava as is required by *In re Lee*.

The final Office Action states that “[c]ombination does not offer problems of any device or method of making nature: the floating gate can be manufactured to be microcrystalline by straightforward application of P-doping (cf. abstract). Reasonable expectation of success is thus valid. Final Office Action, page 18. Shrivastava describes a floating gate of nitrogen doped

amorphous silicon that results in the advantage of fewer stress induced defects. Shrivastava, abstract. The final Office Action has not indicated that the device resulting from the combination of Fujiwara, Weitzel, Hamakawa, Miyawaki, and Shrivastava has a floating gate of amorphous silicon that could benefit from nitrogen doping. The final Office Action has not presented prior art showing a reasonable expectation of success of this particular combination of all of Fujiwara, Weitzel, Hamakawa, Miyawaki, and Shrivastava as is required by *In re Vaeck*.

The rejection is not supported by concrete evidence in the record as is required by *In re Zurko*.

The applicant respectfully submits that a *prima facie* case of obviousness of claims 73, 82, and 85 has **not** been established in the final Office Action, and that claims 73, 82, and 85 are in condition for allowance.

Claims 74 and 77 were rejected under 35 USC § 103(a) as being unpatentable over Fujiwara and Halvis. The applicant respectfully traverses.

Fujiwara relates to a semiconductor device having multiple control gates, and its use in a memory device. Fujiwara, abstract and summary. Halvis relates to a MOS photodetector having an overlapping gate array. Halvis, abstract. Fujiwara is apparently not a photodetector. The addition of carbon in Halvis is described as improving transparency to visible light. Halvis, abstract. The final Office Action has not provided evidence showing why one skilled in the art would apply the teaching of Halvis to the device of Fujiwara which is not a photodetector. The final Office Action has not provided evidence showing a teaching, motivation, or suggestion to select and combine all of Fujiwara and Halvis as is required by *In re Lee*.

The final Office Action states that “[t]he inventions by Fujiwara and Halvis et al can be combined as nothing else would have to be modified in the basic transistor design, except for the carbon content in the polysilicon gate 5.” Final Office Action, page 19. There is no cited evidence supporting this assertion. The final Office Action has not presented prior art showing a reasonable expectation of success of this particular combination of Fujiwara and Halvis as is required by *In re Vaeck*. The rejection is not supported by concrete evidence in the record as is required by *In re Zurko*.

The applicant respectfully submits that a *prima facie* case of obviousness of claims 74 and 77 has **not** been established in the final Office Action, and that claims 74 and 77 are in condition for allowance.

Claims 76 and 79 were rejected under 35 USC § 103(a) as being unpatentable over Fujiwara, Halvis, and Shrivastava. The applicant respectfully traverses.

The final Office Action states that “Shrivastava et al. teach a floating gate that retains its microcrystalline structure so as to have improved stress induced defect problems (cf. abstract).” Final Office Action, page 19. The abstract of Shrivastava states that “silicon oxide grown from the the floating gate (206) has fewer stress induced defects.” Shrivastava, abstract. The final Office Action has not provided evidence that the device from Fujiwara and Halvis as combined includes silicon oxide grown from a floating gate that would benefit from this advantage. The final Office Action has not provided evidence showing a teaching, motivation, or suggestion to select and combine all of Fujiwara, Halvis, and Shrivastava as is required by *In re Lee*.

The final Office Action states that “[c]ombination does not offer problems of any device or method of making nature: the floating gate can be manufactured to be microcrystalline by straightforward application of P-doping (cf. abstract). Reasonable expectation of success is thus valid. Final Office Action, page 19. Shrivastava describes a floating gate of nitrogen doped amorphous silicon that results in the advantage of fewer stress induced defects. Shrivastava, abstract. The final Office Action has not indicated that the device resulting from the combination of Fujiwara, Halvis, and Shrivastava has a floating gate of amorphous silicon that could benefit from nitrogen doping. The final Office Action has not presented prior art showing a reasonable expectation of success of this particular combination of all of Fujiwara, Halvis, and Shrivastava as is required by *In re Vaeck*.

The rejection is not supported by concrete evidence in the record as is required by *In re Zurko*.

The applicant respectfully submits that a *prima facie* case of obviousness of claims 76 and 79 has **not** been established in the final Office Action, and that claims 76 and 79 are in condition for allowance.

Claims 75 and 78 were rejected under 35 USC § 103(a) as being unpatentable over Fujiwara, Halvis, and Miyawaki. The applicant respectfully traverses.

The final Office Action states that “p-substrates in silicon-based transistor art should be preferred because of the electron mobility exceeds the hole mobility.” Final Office Action, page 20. Evidentiary support for the existence and meaning of this scientific theory has not been provided as is required by MPEP 2144.02. The final Office Action has also not provided evidence showing a teaching, motivation, or suggestion to select and combine all of Fujiwara, Halvis, and Miyawaki as is required by *In re Lee*.

The final Office Action states that “silicon dioxide is widely used as gate insulation layer for its excellent insulator properties, while silicon dioxide can be made from silicon by thermal oxidation; hence combinability of the inventions is guaranteed with reasonable expectation of success.” Final Office Action, page 20. The final Office Action has not presented prior art showing this reasonable expectation of success of this particular combination of Fujiwara, Halvis, and Miyawaki as is required by *In re Vaeck*.

The rejection is not supported by concrete evidence in the record as is required by *In re Zurko*.

The applicant respectfully submits that a *prima facie* case of obviousness of claims 75 and 78 has **not** been established in the final Office Action, and that claims 75 and 78 are in condition for allowance.

Claim 98 was rejected under 35 USC § 103(a) as being unpatentable over Fujiwara, Weitzel, Hamakawa, and Miyawaki. The applicant respectfully traverses.

The final Office Action states that “it is generally understood in the art that silicon dioxide is a very good interlayer dielectric.” Final Office Action, page 20. The final Office Action has not provided evidence supporting this assertion. The rejection is not supported by concrete evidence in the record as is required by *In re Zurko*.

The final Office Action has not presented prior art showing a reasonable expectation of success of this particular combination of all of Fujiwara, Weitzel, Hamakawa, and Miyawaki as is required by *In re Vaeck*.

The final Office Action has not provided evidence showing a teaching, motivation, or suggestion to select and combine Fujiwara, Weitzel, Hamakawa, and Miyawaki as is required by *In re Lee*.

The applicant respectfully submits that a *prima facie* case of obviousness of claim 98 has **not** been established in the final Office Action, and that claim 98 is in condition for allowance.

Claim 99 was rejected under 35 USC § 103(a) as being unpatentable over Fujiwara, Weitzel, Hamakawa, Miyawaki, and Shrivastava. The applicant respectfully traverses.

The final Office Action states that “it is generally understood in the art that silicon dioxide is a very good insulators.” Final Office Action, page 21. The final Office Action has not provided evidence supporting this assertion. The rejection is not supported by concrete evidence in the record as is required by *In re Zurko*.

The final Office Action states that “Shrivastava et al. teach a floating gate that retains its microcrystalline structure so as to have improved stress induced defect problems (cf. abstract).” Final Office Action, page 21. The abstract of Shrivastava states that “silicon oxide grown from the the floating gate (206) has fewer stress induced defects.” Shrivastava, abstract. The final Office Action has not provided evidence that the device from Fujiwara, Weitzel, Hamakawa, and Miyawaki as combined includes silicon oxide grown from a floating gate that would benefit from this advantage. The final Office Action has not provided evidence showing a teaching, motivation, or suggestion to select and combine all of Fujiwara, Weitzel, Hamakawa, Miyawaki, and Shrivastava as is required by *In re Lee*.

The final Office Action has not presented prior art showing a reasonable expectation of success of this particular combination of all of Fujiwara, Weitzel, Hamakawa, Miyawaki, and Shrivastava as is required by *In re Vaack*.

The applicant respectfully submits that a *prima facie* case of obviousness of claim 99 has **not** been established in the final Office Action, and that claim 99 is in condition for allowance.

CONCLUSION

The applicant respectfully submits that all of the pending claims are in condition for allowance, and such action is earnestly solicited. The Examiner is invited to telephone the below-signed attorney at 612-373-6973 to discuss any questions which may remain with respect to the present application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

LEONARD FORBES ET AL.

By their Representatives,


SCHWEGMAN, LUNDBERG, WOESSNER & KLUTH, P.A.

P.O. Box 2938

Minneapolis, MN 55402

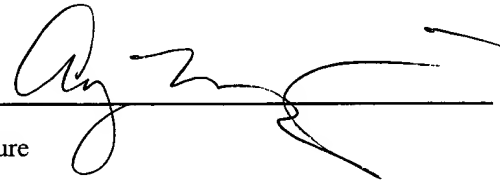
612-373-6973

Date 28 JULY 2003

By 
Robert E. Mates
Reg. No. 35,271

CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: Mail Stop RCE, Commissioner of Patents, P.O.Box 1450, Alexandria, VA 22313-1450, on this 28th day of July, 2003.

Amy Moriarty
Name


Signature